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ABSTRACT

The thinking processes of teachers as they relate to classroom planning, judgment, decision making, and individual theories or perspectives are examined. On the topic of planning, it is suggested that teachers do not seem to follow the "rational model" prescribed in teacher training and curriculum planning. Rather, planning seemed to begin with the content to be taught and considerations about the setting in which teaching will take place. Findings on teacher judgment about students were mixed on the extent to which teachers' judgments are flexible and responsive to new information. Teachers varied in the accuracy of their predictions of student achievement and the weights that they assign to factors that influence their judgment. The results of this study indicated that teacher interactive decision making occurred primarily at times when there were interruptions of the ongoing instructional processes, and that teachers tended not to change the instructional process in midstream, even when it was going poorly. Teacher thinking and teacher behavior were observed as being guided by a set of organized beliefs, often operating unconsciously. The connection between a teacher's implicit theories and behavior appeared to be mediated by circumstances such as availability of resources, peer influence, and student characteristics. (JD)

Research Series No. 12

RESEARCH ON TEACHER THINKING

Christopher M. Clark
Robert J. Yinger

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Contents

Research on Teacher Thinking[1]

Christopher M. Clark and Robert J. Yinger[2]

A relatively new approach to the study of teaching assumes that what teachers do is affected by what they think. This cognitive information-processing approach concerns teacher judgment, decision making, and planning. The study of the thinking processes of teachers--how teachers gather, organize, interpret, and evaluate information--is expected to lead to an understanding of the uniquely human processes that guide and determine teacher behavior.

This view of teaching developed as a logical outgrowth of approaches to research on teaching emphasizing teacher behavior. The teacher behavior approach has contributed a great deal to our knowledge of what teachers and students do in classrooms and how this behavior relates to student learning and attitudes (see Rosenshine, 1971; Dunkin & Biddle, 1974; Medley, in press). But if the results of such research are to be applied by individual teachers in their classrooms, adaptations will have to be made. Each class consists of a unique combination of personalities, constraints, and opportunities. Teacher behavior that is sensible and effective in one setting may be inappropriate in a second setting, and it is the individual teacher who makes decisions about appropriateness and

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[1]This paper is scheduled to appear in Curriculum Inquiry. In addition, it will be published in 1979 in Conceptions of Teaching, edited by P.L. Peterson and H.J. Wolberg and part of a series on Contemporary Education published by the National Society for the Study of Education.

[2]Christopher M. Clark, coordinator of a study on teacher planning, is a researcher at the Institute for Research on Teaching and an assistant professor of educational psychology. Robert J. Yinger is also an IRT researcher and co-investigator with Clark in the teacher planning study.

defines the teaching situation. Therefore, if research is to be put into practice--if a general case is to be applied in particular situations-- then we must know more about how teachers exercise judgment, make decisions, define appropriateness, and express their thoughts in their actions.

Several metaphors have been used to describe the teacher in this view of teaching. The teacher has been called a clinical information processor (Shulman & Elstein, 1975, Shulman, 1975), a decision maker (Shavelson, 1973; Clark & Joyce, Note 1), a planner (Yinger, Note 2), a diagnostician (Vinsonhaler, Wagner, & Elstein, Note 3), and a problem solver (Joyce & Harootunian, 1964). Yet, whatever metaphor is used, the mental processes that underlie behavior are always the focus of study. Research via this approach often depends upon teachers' self-reports of their thought processes (see for example, Clark & Peterson, Note 4; Morine & Vallance, Note 5; Yinger, Note 2; Bussis, Chittenden, & Amarel, 1976). These self-reports have been obtained by a variety of methods ranging from questionnaires and interviews to "thinking aloud" procedures in which a teacher speaks into a tape recorder while planning and "stimulated recall" techniques (Bloom, 1954; Kagan, Krathwohl, Goldberg, & Campbell, 1967) in which a teacher views a videotape of his or her own teaching and attempts to report on the decisions and judgments made while teaching.

In addition to teachers' self-reports of various kinds, techniques for describing teacher judgment and decision making have been borrowed from the psychological laboratory, especially policy-capturing techniques using the lens model of Egon Brunswick (Hammond, 1971; Rapoport & Summers, 1973). Attempts have even been made to write computer

programs that are modeled on the decision-making behavior of expert reading diagnosticians (Bader, Vinsonhaler, Gardner, Wagner, Shulman, Elstein, & Weinshank, Note 6).

What have we learned about the mental lives of teachers? To date, research in this area has been directed at four topics: teacher planning, teacher judgment, teacher interactive decision making, and teachers' implicit theories or perspectives. Each of these areas will be reviewed in turn.

Planning

Until recently, the literature on planning in education has been mainly prescriptive. Many volumes have been written recommending specific principles for curriculum planning (e.g., Anderson, 1956; Caswell & Cambell, 1935; Gwynn, 1943; Krug, 1950; Saylor & Alexander, 1974), and most recent methods textbooks include at least one chapter on teacher planning. Most of the work in curriculum planning to date has focused on a model of curriculum planning first proposed by Tyler (1950) and later elaborated by Taba (1962) and Popham and Baker (1970). This model recommends four essential steps for effective planning:

1. Specify objectives,
2. Select learning activities,
3. Organize learning activities,
4. Specify evaluation procedures.

This model is basically a rational means-ends model in which a planner's first task is deciding what is to be accomplished, and then selecting the appropriate learning activities to accomplish it. Curriculum planning is characterized as a task that requires orderly and careful thinking, and this model is proposed as a rational and scientific method for accomplishing such a task (Taba, 1962).

The only departure from this rational model of teacher planning that has been advocated is the "integrated ends-means model" (Zahorik, 1975) suggested by MacDonald (MacDonald, 1965; MacDonald, Wolfson, & Zaret, 1973) and Eisner (1967). They propose that teachers do not begin their planning by thinking about objectives and then proceeding to decisions about activities, evaluation, and so forth; rather, teachers first focus on the type of learning activity that will be provided for the students. They argue that objectives arise and exist only in the context of an activity, as a result of students choosing their own learning experiences and pursuing their own objectives. Thus, in this model, ends for learning become integrated with means for learning, and the specification of goals prior to an activity becomes meaningless.

Though some researchers have long pointed out the importance of looking at teacher behavior in the preactive setting (Jackson, 1965), relatively few studies have ventured into this domain. Empirical studies of teacher planning have only been conducted since 1970, and to date, the published studies can still be counted on one hand.

The first empirical study of classroom planning was done by Zahorik (1970), who examined the effect of structured planning on teacher classroom behavior. He provided six of his sample of 12 teachers with a partial lesson plan containing behavioral objectives and a detailed outline of content to be covered two weeks hence. He requested the remaining six teachers to reserve an hour of instructional time to carry out a task for the researchers, not telling them that they were going to be asked to teach a lesson on credit cards until just before the appointed time. Zahorik analyzed recorded protocols of the 12 lessons focusing on "teacher behavior that is sensitive to students" (p. 144). He defined this behavior as "verbal acts of the teacher

that permit, encourage, and develop pupil's ideas, thoughts, and actions" (p. 144). Upon examining the protocols of the planners and non-planners, Zahorik noted that teachers who planned exhibited less honest or authentic use of the pupil's ideas during the lesson. He concluded from this that the typical planning model - goals, activities and their organization, and evaluation - results in insensitivity to pupils on the part of the teacher.

Taylor (1970) conducted a study of teacher planning in British secondary schools directed towards examining how teachers planned syllabi for courses (though this seems to be more a study of curriculum planning than of individual teacher planning). By means of group discussion with teachers, analyses of course syllabi, and the administration of a questionnaire to 261 teachers of English, science, and geography, Taylor came to the following general conclusions. The most common theme found across all of the data collection modes was the prominence of the pupil; especially his/her needs, abilities, and interests, followed by the subject matter, aims (goals), and teaching methods, in order of importance. In planning for courses of study, evaluation was not very important, nor was the relation between one's own course and the curriculum as a whole. Taylor concluded that most course planning was unsystematic and "only general" in nature and that most teachers appeared far from certain about what the planning process requires. From the study of syllabi, Taylor found large variation in style, size, and content and concluded that there is little consistency in the role that the syllabus plays.

Through teacher ratings of the importance of various issues in curriculum planning and a factor analysis of their responses, Taylor identified four primary factors of interest to his sample of teachers. The results generally

indicated that, when planning, the teachers tended to consider, in order of importance: 1) factors associated with the teaching context (e.g., materials and resources), 2) pupil interest, 3) aims and purposes of teaching, and 4) evaluation considerations. Rather than beginning with purposes and objectives and moving to a description of learning experiences necessary to achieve the objectives (as the rational planning theorists propose), Taylor found that these teachers began with the context of teaching, next considered learning situations likely to interest and involve their pupils, and only after this considered the purposes their teaching would serve. Also, contrary to the theorists' ideas, criteria and procedures for evaluating the effectiveness of the teachers' course of teaching was an issue of only minor importance. These findings led Taylor to conclude that curriculum planning should begin with the content to be taught and accompanying important contextual considerations (e.g., time, sequencing, resources), followed by considerations of pupil interests and attitudes, aims and purposes of the course, learning situations to be created, the philosophy of the course, the criteria for judging the course, the degree of pupil interest fostered by the course, and finally, evaluation of the course.

Zahorik (1975) continued this line of inquiry by examining the use of behavioral objectives and the "separate ends-means" model of planning as well as the use of the "integrated ends-means" model proposed by MacDonald (1965) and Eisner (1967). He asked 194 teachers to list in writing the decisions that they make prior to teaching and the order in which they make them. He classified these decisions into the following categories: objectives, content, activities, materials, diagnosis, evaluation, instruction, and organization. He found that the greatest number of decisions concerned

pupil activities (indicated by 81% of the teachers). The decision most frequently made first was content (51%), followed at a distant second by behavioral objectives (28%).

Zahorik concluded from this study that teacher planning decisions do not always follow logically from a specification of objectives and that, in fact, objectives are not a particularly important planning decision in terms of how often they are used. He also argued that the integrated ends-means model does not appear to be a functioning reality because of the relatively few teachers (only 3%) who began their planning by making decisions about activities.

Only recently has research on teacher planning begun to focus on describing teacher decision making in actual planning situations. Peterson, Marx, and Clark (in press) examined planning in a laboratory situation as 12 teachers prepared to teach a new instructional unit to groups of junior high school students with whom they had had no previous contact. These units were taught to three different groups of eight students on three different days. During their planning periods, teachers were instructed to "think aloud," and their verbal statements were later coded into planning categories such as objectives, materials, subject matter, and process. The following results were obtained from this study: (1) teachers spent the largest proportion of their planning time dealing with the content (subject matter) to be taught, (2) after subject matter, teachers concentrated their planning efforts on instructional processes (strategies and activities), and (3) the smallest proportion of their planning time was spent on objectives. These findings were consistent with those of Zahorik (1975) and

Goodlad, Klein, & Associates (1970) and others. The third finding was also similar to results reported by Joyce and Harootunian (1964) and by Popham and Baker (1970).

Since the Peterson et al. study was conducted in a laboratory situation, with students and materials that the teachers were dealing with for the first time, the results of their study may or may not be generalizable to an actual classroom situation. However, a study by Morine (Note 7) in a semi-controlled classroom setting, found results consistent with those of Peterson et al. Morine collected written plans for two experimenter-prescribed lessons (one in mathematics and one in reading) taught by the teachers in their own classrooms to a subset of her students. Teacher plans were analyzed according to (1) specificity, (2) general format, (3) statement of goals, (4) source of goal statements, (5) attention to pupil background and preparation, (6) identification of evaluation procedures, and (7) indication of possible alternative procedures. Morine found that teachers tended to be fairly specific and use an outline form in their plans, yet paid little attention to behavioral goals, diagnosis of student needs, evaluation procedures, and alternative courses of action.

In a simulated setting, Morine had teachers plan a reading program for 14 new students. The task was designed to identify the kind of information teachers consider important for planning a reading program for a school year. Information was available from cumulative records for each student, and the resulting plans were analyzed according to the types of information about pupils that teachers requested, grouping procedures used, and the differential use of materials and support services. Morine found that, as a group, the teachers tended to ask for the same kinds of information, were

fairly accurate in identifying the pupils' reading levels, and differed little in grouping practices and use of support services.

Yinger (Note 2) studied teacher planning by means of a detailed case study of the processes involved in one elementary (first-second grade) teacher's planning decisions during a five-month period of instruction. The study was designed to address a need for descriptions and theoretical models of planning processes and to examine the usefulness of certain decision-modeling methods for describing complex decisions as they occur in field settings. To accomplish this, Yinger used the perspectives and methodologies of both ethnography and information-processing psychology.

The study involved two phases of data collection. In the first 12 weeks, approximately 40 full days were spent observing and recording the teacher's activities in both the preactive and interactive phases of teaching. Also during this phase, the teacher's planning decisions were recorded as she "thought aloud" during her planning sessions. During the second phase of the data collection, the teacher's planning was investigated through observations of her behavior in the Teacher Planning Shell (a simulation task developed for this study, see Yinger, note 2 for details), and in three judgment tasks examining her perceptions of students and instructional activities. Additional classroom observations and interviews were also conducted during this phase.

Two central aspects of the teacher's planning and instruction that emerged in Yinger's study were: planning for instructional activities and the use of teaching routines. Activities were described as the basic structural units of planning and action in the classroom. They were self-contained, organizational units functioning as "controlled behavior settings" that were

shaped and molded by the teacher to conform to her perceptions and purposes. Seven features of instructional activities were identified and presented as important considerations in planning decisions. The features included: location, structure and sequence, duration, participants, acceptable student behavior, instructional moves or routines, and content and materials.

Teaching routines emerged as another distinctive feature of the teacher's planning technology. Much of the planning behavior could be portrayed as the selection, organization, and sequencing of routines developed as a result of experience. Four types of teaching routines were described: activity routines, instructional routines, management routines, and executive planning routines. Functionally, routines were characterized as methods used to reduce the complexity and increase the predictability of classroom activities, thus increasing flexibility and effectiveness.

Yinger developed two models of planning in his study. The first was a structural model of preactive planning, describing planning at five levels: 1) yearly, 2) term, 3) unit, 4) weekly, and 5) daily. At each level of planning, the teacher's behavior was described in terms of planning goals, information sources used in planning, the form that the plan took, and the criteria used for judging planning effectiveness. This model was used for identifying different types of planning and for proposing strategic research sites for further study.

The second model of planning generated in this study was a theoretical model of teacher planning. In addition to data collected in this study, the process model was based on the findings of other teacher planning studies and on studies of planning in chess, musical composition, art, and architectural design. Planning decisions were characterized by processes emphasizing problem finding and problem formulation as well as problem solving. In con-

trast to traditional models of planning emphasizing the statement of goals, the specification of alternatives, and the choice among alternatives, this model placed more emphasis on finding and developing the planning problem and on the design process.

Three stages of planning were represented in the planning model. The first stage, problem finding, was portrayed as a discovery cycle where the teacher's goal conceptions, her knowledge and experience, her notion of the planning dilemma, and the materials available for planning interacted to produce an initial problem conception worthy of further exploration. The second stage was problem formulation and solution; the mechanism proposed for carrying out this process was the "design cycle." In this cycle, problem solving was characterized as a design process involving progressive elaboration of plans over time. Elaboration, investigation, and adaptation were proposed as phases through which plans were formulated. The third stage of the planning model involved implementation of the plan, its evaluation, and its eventual routinization. This stage emphasizes the contribution of evaluation and routinization to the teacher's repertoire of knowledge and experience, which in turn play a major role in future planning deliberations.

Teacher Judgment

Judgment is thought to be one of the important cognitive processes in the mental life of the teacher. Johnson (1972) defines judgment as the "assignment of an object to a small number of specified categories" (p. 339). Cognitive psychologists (e.g., Newell, 1968; Johnson, 1955, 1972) locate judgment at the end of a sequence of operations within problem solving where it is brought to bear in selecting the most promising alternatives for problem solution. This view of judgment follows the jurisprudential model of collecting evidence on all sides of an issue and weighing the evidence carefully before reaching a conclusion.

When is judgment most important in teaching? At this early stage of research on teacher thinking an empirically-based answer to this question is not yet available. Various studies suggest that teacher judgment plays an important part in predicting student cognitive and affective achievement (Marx, 1978; Shavelson, Cadwell, & Izu, 1977; Joyce, Morine-Dershimer, & McNair, Note 8), predicting teachers' use of instructional moves (Shavelson et al., 1977), teacher planning (Yinger, Note 2), teachers' recognition of effective teaching (Anderson, 1977), and selecting instructional activities (Clark, Wildfong, & Yinger, Note 9). It seems likely that teacher judgment is important in many other contexts as well; the brevity of this list is largely due to the newness of this area of investigation.

Researchers to date have described factors taken into account by teachers and the relative weights given to these factors in reaching a judgment (the judgment process). They have also investigated the accuracy of teacher judgments, particularly teacher predictions of student achievement or attitudes. Finally, methodological questions dealing with matters such as how

teachers use information of varying reliability and how varying the amount of information available affects the judgment process or judgmental accuracy have also been explored.

Anderson (1977) studied the judgment policies of 164 high school teachers, whom she asked to rate 36 different hypothetical descriptions of teachers on a 9-point scale ranging from "a very poor high school teacher" to "an outstanding high school teacher." Each teacher rated one of six different sets of profiles. The sets were varied in the number of teacher characteristics (4, 6, or 8) included in the profiles and in the form of presentation of these characteristics (verbal statements or numerical values). After rating the profiles, each teacher was asked to (1) rate the importance of each teacher characteristic individually on a 9-point scale and (2) rank order the teacher characteristics.

The teacher characteristics or "cues" used in the profiles for this study were selected by Anderson on the basis of previous research concerning teacher quality (e.g., Bridges, Ware, Brown, & Greenwood, 1971; Isaacson, McKeachie, Milholland, Lin, Hoefeller, Boerwaldt, & Zinn, 1964; Rosenshine & Furst, 1971). The cues were:

1. Homework requirements
2. Interest in individual students
3. Establishment of objectives
4. Fairness in grading
5. Knowledge of subject
6. Clarity of explanations
7. Encouragement of class discussion
8. Enthusiasm

Anderson found that the teacher characteristics most important in reaching a judgment of teacher effectiveness were: interest in individual students, knowledge of subject, and clarity of explanations. The characteristic least important to these judgments was homework requirements. Teachers who rated verbal profiles were significantly less consistent in their rating than those who rated numerical profiles. That is, the correlations between the level of a particular cue and the rating given that profile by a teacher were more stable when teachers rated numerical profiles. The number of cues available did not influence the consistency of teacher ratings.

When Anderson compared teachers' ratings of the importance of cues in their own judgment with their actual use of these cues in making judgments, she found strong agreement. This was especially true for cues considered to be least important, namely, homework requirements, encouragement of class discussion, and establishment of objectives. For the cues considered to be most important, however, there were inconsistencies between teacher ratings of cues and their use of these cues to judge profiles. Enthusiasm, for example, was rated and ranked very high, but when the teachers rated profiles, other characteristics such as knowledge of subject and fairness in grading were taken into account more strongly than enthusiasm. This finding indicates that, when making judgments, teachers may base their decisions on a policy that is different from the policy they report using.

A study by Shavelson et al. (1977) investigated the sensitivity of teacher judgment to the reliability of information received and teacher willingness to revise initial judgments when presented with additional information. One hundred and sixty-four graduate students in education (119

of whom were teachers) were given information describing Michael, a hypothetical fifth-grade student. (Analysis of the data indicated that there were no differences between teachers and non-teachers; therefore, we will refer to all participants in this study as teachers.) Three types of information about the hypothetical student were provided: father's occupation, the student's use of time, and the student's intelligence. Each teacher was presented with one student description containing either positive or negative information from either a reliable or unreliable source. After reading the information about the student, the teachers responded to four questions that required an exercise of judgment:

1. What is the probability that Michael will get mostly As and Bs on his report card?

2. In selecting instructional materials for Michael in reading and math at the beginning of the semester, what kinds of texts and instructional aids would you primarily use?

   a. Fifth grade level
   b. Fifth grade level and/or above
   c. Fifth grade level and/or below

3. Suppose that during a math lesson, you ask Michael a question and he hesitated. Would you:

   a. Rephrase the same question in order to clarify it?
   b. Ask a similar question that is easier to answer?
   c. Further explain the problem, then repeat the same question to Michael?
   d. Ask the same question to another student?
   e. Answer the question yourself?

4. How important is it for Michael that you make a point of praising him every time he does good work?

   a. Very important
   b. Important
   c. Somewhat important
   d. Somewhat unimportant
   e. Not important at all

After answering these questions the teachers were given additional information that was again varied systematically as to reliability and positive or negative valence. This additional information concerned academic ability, curiosity, and attitude towards school. The teachers again answered the same four questions in light of this new information but without referring to their earlier answers.

The major finding of this study was that teachers were sensitive to reliability of the information they received and that they revised their initial predictions of student achievement when presented with additional information. These findings contradict those reported by Tversky and Kahneman (1974), who reviewed studies that examined the ways in which people assess the probabilities of occurrence of uncertain events or values of unknown quantities. They found that people in general were neither sensitive to the reliability of information nor did they tend to revise judgments after additional information was presented.

Concerning the judgment of which kind of instructional material to select for the hypothetical student, the teacher's estimate of the student's ability (i.e., the teacher's answer to Question 1) was the major factor in making this decision. However, after additional information had been given to the teacher, this judgment was significantly influenced by the teacher's revised estimate of the student's ability, by the reliability and valence of the new information, and by the teacher's original estimate of the student's ability.

The teachers' answers to the questions about instructional moves (questioning and reinforcement strategies) indicated that there was no systematic relationship between the descriptions of the student and teacher

predictions about their own pedagogical behavior. The authors suggest that teachers' responses to these latter two judgment tasks depended on factors not measured in the experiment, such as personal preference for teaching style or philosophy of teaching.

Mondol (Note 10) undertook a study to investigate the possibility of training teachers to modify their judgment policies by using a form of cognitive feedback (Hammond, 1971) coupled with training regarding the relevance of various information sources. Fifty-four teachers in training were asked to judge the likelihood of 108 hypothetical students being instructional problems in a classroom setting. These student descriptions were developed by presenting all possible combinations of five descriptive variables: SES, IQ, grades, sex, and comments about student personality. For each teacher's judgments, a multiple regression analysis was conducted which produced a measure of the teacher's judgment "policy" (the relative weights assigned to each variable). Teachers then participated in feedback and training sessions in which their judgment policies and the cue variables were discussed. After these sessions, the teachers again rated the same set of student descriptions on the same question.

Mondol found significant changes in those teachers who participated in the training and feedback sessions as compared to those teachers who had no training or feedback. She found that the training-and-feedback teachers made fewer deviations from the optimal policy at which the training was directed than did the control (no-feedback/training) teachers. This change in judgment policy was largely due to a more equal weighting of the five information sources by the teachers receiving training and feedback. Mondol concluded from this study that cognitive feedback and

training can be successfully used to modify judgment policies of teachers. She further concluded that if optimal weighting patterns can be developed for important teacher judgments, training programs could be developed to facilitate the learning of more effective and efficient decision making.

One of the difficulties in designing studies of teacher judgment is identifying the cues or features of the objects to be judged that the teachers will actually use in coming to a judgment. One approach to this problem involves the researcher selecting features based on his or her interests, prior experience, or review of empirical literature dealing with the phenomena of interest. Another approach involves selection of cues after informal discussion between the researcher and experienced judges. A third approach is represented in a study by Clark et al. (Note 9), wherein the researchers attempted to identify the features of language arts teaching activities that influenced teacher judgment about the quality and potential usefulness of these activities. Fourteen experienced elementary school teachers examined descriptions of 26 language arts activities in the area of writing taken from a commercial catalog of language arts activities. The teachers rated each activity as high, medium, or low in attractiveness for teaching in their classrooms. After rating all of the activities, the teachers reexamined each activity rated high and listed the features that contributed to their judgment of the activitiy's attractiveness. The teachers then repeated this procedure for the activities rated low in attractiveness.

To identify the important features that influenced the judgments of this group of teachers, the following procedure was used:

1. Each activity feature identified by the teachers was typed on a 3 x 5 card; 407 of these statements were produced.

2. Two of the researchers independently categorized each of the 407 teacher statements.

3. The two researchers compared their categorizations of the teacher statements, clarified their own policies for categorization, and negotiated a final set of 13 categories into which all 407 teacher statements could be sorted.

The features of the language arts activities identified by the teachers as influential in their judgment are listed in the table below. These features have been grouped under four headings: features of activities that relate to students, the subject matter, the teacher, and the learning environment.

Table:
Features of Language Arts Activities Identified as Influences on Teacher Judgment

Feature Category	Frequency of Use
STUDENTS	
Motivation and Involvement	104
Cognitive Outcomes	67
Affective Outcomes	44
SUBJECT MATTER AND MATERIALS	
Difficulty	68
Fit Between Purpose and Process	35
Meaningfulness	16
Tangible Product	15
Clarity	11
Integration	6
TEACHER	
Fit with Style	11
Demand on Teacher	8
Benefit for Teacher	3
ENVIRONMENT	
Fit with Behavior Setting	19

In this judgment exercise, the teachers most frequently mentioned activity features that were related to student behavior. Student motivation and involvement was mentioned most frequently as a basis for accepting or rejecting a language arts activity, followed by features of activities thought to influence cognitive or affective student outcomes.

In the subject matter category of activity features identified by teachers, the feature singled out most frequently was the estimated difficulty of the activity for that teacher's class. This feature's frequency of mention was probably inflated due to the fact that the language arts activities were intended for students in the upper elementary grades, while four of the teachers taught primary grade students.

Half of the activity features that relate to the teacher were concerned with the match between the activity description and the teacher's prediction of how comfortable he or she would be in executing this activity. The remaining features in this category had to do with how difficult the activity would be to set up, manage, and evaluate, and whether the activity provided benefit to the teacher in addition to its stated purpose.

The final category of features identified had to do with how well that activity seemed to fit into the particular classroom organization in which the teacher was working. For example, some activities were judged to be particularly appropriate for use in learning centers.

An analysis of the teacher comments concerning the four activities rated highest by all teachers and the five activities rated lowest indicated that the activity feature contributing most strongly to positive teacher judgments was student motivation and involvement. The second most frequent influence on positive teacher ratings was difficulty level of the activity.

The third feature contributing to positive teacher judgments was the fit between the stated purpose of the activity and the process of teaching involved in the activity. That is, activities rated highest by the teachers were those high on student motivation and involvement, low in difficulty, and those that were perceived as good ways to teach the content. In the case of the five activities rated lowest, the most powerful influence identified by the teachers was the difficulty of the activity for students. The second feature that influenced teachers to reject these activities was the amount of demand that the activity placed on the teacher. That is, activities were rated as unattractive if they were seen as too difficult for the students or too demanding for the teacher.

Marx (1978) studied the judgment that teachers exercise when they predict cognitive and affective student achievement. Twelve experienced teachers taught a series of three social studies lessons to groups of eight junior high school students in a laboratory setting. The teachers had not met these students before the teaching episodes began. After each of the three 50-minute lessons, the teachers made predictions of the rank-order of their students on both a cognitive achievement test and an attitude inventory to be administered immediately after the third teaching session. In addition, the teachers were asked to describe the student behavior or other cues that they used in making predictions about each student.

Marx found that these teachers were not specific about the behavioral cues on which they based their judgments about future achievement and attitudes. The most frequently mentioned cue was "student participation," but the teachers did not identify observable behaviors from which they inferred student participation.

Marx also found that regression equations using the behavioral cues identified by teachers as entering into their judgments were not good predictors of actual student achievement and attitude inventory results. The data on one of the 12 teachers studied suggests that teacher judgments about student attitudes may be more accurate than teacher judgments about cognitive achievement. For this teacher, the correlation between predicted student performance on the attitude inventory and the actual student performance on the attitude-toward-self scale was .72. For all teachers combined, the median correlation between teacher predictions and student outcomes was .24 for achievement and .35 for attitude-toward-self.

Another study of teacher judgments of students was conducted by Joyce et al. (Note 8). Ten teachers in the same elementary school performed a pupil sort activity in which they were asked to sort cards containing the names of each of their pupils into two or more categories. The teachers were then asked to describe the basis on which pupils were assigned to these different categories. This procedure was repeated several times until the teachers could think of no more categories into which to sort their students. This pupil sort technique was used five times during the school year: in September (at the end of the first day of school), November, January, March, and June.

The categories that were most frequently used by teachers in sorting their students were student personality and student involvement. Other bases for pupil sorts were (in order of frequency) student ability and achievement, peer relationships, student performance in a particular activity, and student growth and progress. The high frequency of student involvement as a basis for the pupil sort is consistent with Marx's findings cited above

and with the findings in the Clark et al. (Note 9) study.

An additional procedure used in the Joyce et al. study was to ask the teachers to predict student end-of-year reading achievement. The teachers made these predictions twice, once at the end of the first day or school and once in November. The most striking finding from this part of the study was that teacher predictions of reading success did not differ substantially between September and November, even though the teachers presumably had much more information about their students based on three months of experience and the availability of diagnostic reading test results. This remarkable stability of teacher judgments contrasts with findings of Shavelson et al. (1977) in which teachers did change their judgments after additional information was made available.

In predicting end-of-year reading achievement, teachers were most accurate in their predictions of which students would be most successful. Teachers were less accurate in discriminating between students who would make average progress and those who would make below average progress.

Teacher Interactive Decision Making

Interactive decision making refers to those decisions made during the act of teaching. The teacher is seen as a decision maker who is constantly assessing the situation, processing information about the situation, making decisions about what to do next, guiding action on the basis of these decisions, and observing the effects of these actions on students. The fundamental question underlying this work is, "What fraction of teaching is reflective and what fraction is reactive?" It is the anatomy of the reflective portion of teaching that is interesting to researchers on teacher interactive decision making.

All studies of teacher interactive decision making depend on the teacher's self-report of the decision made. The most common method of obtaining these self-report data is some variation of a procedure in which a videotape of the teacher's teaching performance is replayed to stimulate recall of the teaching situation. In some studies only short segments of the videotape are replayed (e.g., Clark & Peterson, Note 4), while in others the entire videotape is replayed (e.g., Morine & Vallance, Note 5). In the latter case, the videotape may be stopped by the teacher when he or she remembers having made a decision, or the researcher may control the identification of "critical incidents." In most cases, a standard set of questions is asked of the teacher after the viewing of each videotape segment of interest. The teacher's responses to these questions are audiotaped and subsequently described either by use of a coding system and frequency counts, by a narrative process description, or both.

The earliest study of teacher interactive decision making is reported by Clark and Joyce (Note 1), Marx and Peterson (1975), and Clark and Peterson (Note 4). Twelve experienced teachers taught a social studies unit to three

a previous study (Berliner, Note 11) as more effective and less effective. Three major types of decisions were identified: (1) interchanges (decisions relating to instantaneous verbal interaction), (2) planned activities (interactive decisions directly related to preactive decisions), and (3) unplanned activities (decisions to include an activity not originally part of the lesson plan). In general, the researchers found that nearly all of the decisions could be categorized as either interchange or planned decisions (approximately 48% in each category) and that there was only slight grade level variation in this pattern.

When responses of more and less effective teachers were compared, no significant differences were found. A general pattern observed in all teachers' responses was that teachers focused more on the instructional process than on student characteristics or behavior when commenting on the substance (focus) of their decisions. When the considerations and bases for the teachers' decisions were referred to, however, the focus changed. In these instances, student characteristics were more prominent than instructional process considerations. Additional findings in the study were that few decision alternatives were mentioned by the teachers and that references to cognitive aspects of the lesson were more frequent than references to affective aspects.

Marland (Note 12) studied the interactive thoughts of six volunteer teachers from two schools, two each at the first, third, and sixth-grade levels. Each teacher participated in two stimulated recall sessions; videotapes of language arts and mathematics lessons were used for the teachers of first and third grades, and two language arts lessons were used with the

sixth-grade teachers.

Marland analyzed the transcripts of stimulated recall interviews using two different category systems; the first analysis a category system developed by Marland himself. Each "thought unit" was judged to be in one of 11 categories: perceptions, interpretations, prospective tactical deliberations, retrospective tactical deliberations, reflections, anticipations, information-pupil, information-other, goal statements, fantasies, and feelings.

For the second analysis, Marland examined the transcripts for instances of psychologically meaningful events including: decisions, forfeit decisions, deliberate acts, impulsive acts, cognitive linking, field detachment, externality, internality, principles, beliefs, rules, case histories, and instances of accurate or inaccurate recall by teachers.

Marland's results are summarized below under three headings: Content of Teachers' Interactive Thoughts; Function of Teachers' Interactive Thoughts; Individual Differences in Teachers' Interactive Thoughts.

Content of Teachers' Interactive Thoughts

The teachers studied by Marland reported thinking about topics and events in the present, past, and future. Present events included student behavior, teachers' interpretations of student behavior, and the teachers' own affective states. Teachers' thoughts about the past included reflections on past events in a lesson and retrieval from memory of factual information thought to be useful in a lesson, such as personal information about particular students, curriculum content, principles of teaching, and beliefs about children. Teachers' thoughts about the future included tactics to be used next, predictions or visualizations of directions the lesson might take, expectations for student behavior, and student learning objectives.

Interactive thoughts most frequently reported by teachers were prospective tactical deliberations (20.3%), reflections (18.8%), perceptions (15.6%), interpretations (11.9%), and anticipations (8.7%). Interactive thoughts concerning information-pupil, information-other, and feeling accounted for 5 to 10% of the thoughts reported. Relatively few thoughts were reported in the remaining categories of tactical deliberation retrospective, goal statement, and fantasy.

The Function of Teachers' Interactive Thoughts

Marland's data on the functions of teachers' interactive thoughts indicate that four functions account for the majority of the cases: (1) correcting or adjusting the lesson when it is not going smoothly, (2) dealing with parts of the lesson that are unpredictable in principle (e.g., prompting a student who gives a partial answer), (3) regulating own behavior by reference to certain principles of teaching, and (4) adapting instruction to individual students. Conspicuous by their absence from the teachers' protocols were four other possible functions of teachers' interactive thoughts: teacher self-monitoring, checking of the accuracy of teacher interpretatons of student behavior, consideration of alternative teaching tactics, and optimization of instruction. Teachers rarely gave any consideration to their own teaching style, its effectiveness, and impact on students. They tended to operate on the basis of hunches and intuitions about student cognitive and affective states rather than treating first impressions as hypotheses to be tested by further observation or direct questions. Teachers did think about tactical moves to be made in a lesson, but usually without considering alternatives. Finally, the teachers tended not to think about improving an instructional situation except when it was going poorly.

Individual Differences and Teachers' Interactive Thoughts

An intriguing relationship between the teacher individual difference measure and teachers' self-reports of interactive thoughts was that one teacher (characterized as having an abstract belief system) was more open to making adjustments to expectations held for students compared to the remaining five teachers (all of whom were characterized as having concrete belief systems). There were no other systematic relationships between teacher information processing and teacher presage and contextual variables.

Teachers' Implicit Theories

Because much of the judgment and decision making that teachers exercise follows from interpretations of their experiences, it is important to study how teachers make sense of their world. The study of teacher thinking is based in part on the assumption that, in creating a problem space, the teacher refers to a personal perspective (Janesick, Note 13), an implicit theory (Snow, 1975), conceptual system (Duffy, Note 14), or belief system (Brophy & Good, 1974) about teaching and learning. Thus, the teacher defines such things as the elements of the classroom situation that are most important, the relationships among them, and the order in which they should be considered. (Among researchers, these various ways of characterizing teachers' conceptual bases carry slightly different meanings.) For the purpose of this review we have chosen to use the expression "teachers' implicit theories" to refer to this collection of research, and several different research approaches will be discussed.

Janesick (Note 13) used an ethnographic approach (Wilson, 1977) to derive, describe, and validate the description of the perspective of a single sixth-grade teacher in whose classroom she became a participant-observer for seven months. Extensive field notes based on classroom observations and teacher interviews were analyzed weekly to build and define a description of the teacher's perspective. According to Janesick, a perspective is a reflective, socially-derived interpretation of that which the teacher encounters; this interpretation then serves as a basis for the actions he or she constructs. It is a combination of beliefs and behavior continually modified by social interaction that enables the teacher to make sense of his or her world, interpret it, and act rationally within it.

Janesick found that the perspective of the teacher she studied could be characterized by his concern for creating a stable and cohesive group and maintaining that group. The teacher made plans and interpreted events in terms of their impact on the "groupness" of the class. Most classroom activities were group activities; the teacher considered himself to be the leader of the group and defined his role accordingly. He modeled and emphasized cooperation and respect for other group members and he designed activities that generated a high level group consensus.

A more focused approach to studying teachers' implicit theories has been taken in the subject matter area of reading. Duffy (Note 14) and his colleagues had approximately 350 teachers engage in a Proposition Sort exercise in which they sorted 36 propositions about reading and reading instruction into five categories ranging from "most like me" to "least like me." These propositions were drawn from an analysis of the literature on reading. The analysis revealed five major conceptions of reading: basal text, linear skills, natural language, interest, and integrated whole. An additional category of confused/frustrated was added, and six propositions consistent with each of these conceptions of reading were generated.

From among the 350 teachers who completed the Proposition Sort exercise, 37 teachers manifested clear and strongly-held belief systems about reading. A variation of Kelly's Role Concept Repertory Test (REP Test) was then administered to these teachers in order to refine and specify more clearly their conceptions of reading.

In the second phase of this study, eight teachers who evidenced strong belief patterns on the proposition sort exercise and the REP Test were observed teaching on 10 different occasions. Ethnographic field notes and

post-observation interviews were used to determine the extent to which the teachers' instructional behavior reflected their conceptions of reading. It was found that:

> Only four teachers consistently employed practices which directly reflected their beliefs; these included two teachers who had structured beliefs (basal/linear skills), a teacher who had an eclectic view, and one of the teachers having an unstructured belief system (natural language/ interest/integrated whole). Of those whose practices did not reflect their beliefs, two of the teachers having strong unstructured belief systems were found to be smuggling elements of unstructured practices into an administratively-imposed program reflecting a structured view. Two other teachers holding unstructured views, however, did not consistently reflect their beliefs; one of the teachers employed practices which, to a large degree, were counter to the unstructured belief system she espoused, while a second teacher operationalized unstructured beliefs only some of the time with some pupils and some activities. (Duffy, Note 14 pp. 780)

In the study by Marland (Note 12) described in the section on teacher interactive decision making, one of the analyses of the stimulated recall protocols indicated that teachers referred to certain principles of teaching when explaining their classroom behavior. These principles of teaching appear to serve the same function as what we have called implicit theories. Marland's data yielded five principles of teaching that seemed to profoundly influence teacher behavior or were mentioned by at least two of the six teachers studied: the principle of compensation, the principle of strategic leniency, the principle of power sharing, the principle of progressive checking, and the principle of suppressing emotions.

The principle of compensation represents an attempt on the part of the teacher to discriminate in favor of the shy, the introverted, the low ability group, and the culturally impoverished. Two of the four teachers who applied

this principle were grade one teachers; this principle figured less prominently in the explantions of teachers of higher grades.

The principle of strategic leniency is a variation of the principle of compensation. Strategic leniency refers to a teacher's tendency to ignore infractions of classroom rules by children who the teacher regards as needing special attention.

The principle of power sharing involved the teacher using the informal peer power structure to influence students. In this way, the teacher was seen as sharing both responsibility and authority with certain students. That is, the teacher would selectively reinforce the good behavior of students who she perceived as class leaders in order to use their influence on their peers as an instrument for classroom management.

The principle of progressive checking involved periodically checking progress, identifying problems, and providing encouragement for low ability group students during seat work. In addition to the direct assistance provided during this checking, the teacher who utilized this principle also reasoned that she was providing stimulus variation for students with short attention spans.

The principle of suppressing emotions was derived from teacher reports that they consciously suppressed the emotional feelings that they were experiencing while teaching. This principle was evoked because of the belief that, if they expressed their feelings and emotions, it might overly excite the students and encourage them to express their own feelings and emotions, thus creating a management problem.

A fourth approach to characterizing teachers' implicit theories involves the use of the clinical interview. Bussis et al. (1976) interviewed 60

elementary school teachers who were attempting to implement open or informal approaches to instruction. The objective of the study was to investigate understandings and perceptions regarding curriculum, children, and the working environment. Each teacher was interviewed for approximately two and one-half hours. Transcriptions of the interviews were coded using a coding system developed for this purpose.

To interpret the teachers' understanding of curriculum, the researchers grouped the teachers into four groups that were characterized by different "curriculum construct systems." Group one, which included 12% of the teachers, was characterized as having "grade-level facts and skills" as a dominant priority; there was also little evidence of experiement or change in the curriculum. Group two (comprising 22% of the teachers) also exhibited "grade-level facts and skills" as a dominant priority, but there was much more evidence of change in their experimentation with the curriculum. Whereas the curriculum construct systems of the teachers in group one appeared to be firmly set, the construct system in group two seemed to be less established and there was more emphasis on student involvement. For group three (39%), "grade-level facts and skills" was an expressed priority, but not the dominant one. Broader priorities dominated, and there was more evidence of a potentially rich curriculum. Group four, comprising 25% of the teachers, showed little evidence of preoccupation with "grade-level facts and skills" and was oriented toward more comprehensive priorities.

Findings about teachers' understandings of children were summarized under three headings: Children's Needs and Feelings, Interests and Choice, and Reciprocity in Social Interaction. They grouped the teachers into four orientations on the question of children's emotional needs and feelings:

A. Needs and feelings are only remotely perceived and lack reality (20% of the teachers).

B. Needs and feelings are perceived as real and their expression as desirable, but they are also seen to be in conflict with learning (15% of the teachers).

C. The expression of needs and feelings is seen as a necessary context for learning (32% of the teachers).

D. The expression of needs and feelings is seen as integral to and inseparable from the learning process (33% of the teachers).

In analyzing teacher responses to questions about student interests and student choice, Bussis et al. again grouped teachers according to four orientations. Orientation A teachers (20%) did not talk much about children's interests or choices. These teachers tended to use sex-role stereotypes in the few cases in which they did discuss interests (e.g., boys are interested in science). Student choice was very limited.

Teachers in orientation B (30%) believed that worthwhile learning did occur when children pursued their interests, but student choice was only permitted within elective areas of the curriculum and not within the core subject matters. Student interest was seen as synonymous with enjoyment. Choice was seen as a process of selection from among a few opportunities presented by the teacher. As with those oriented toward group A, these teachers thought about interests and choice in terms of group propensities (e.g., the interests of fifth-grade boys) rather than as individual traits or states.

Orientation C teachers (22%) differed from Orientation B teachers in that they thought about interests and choice in terms of individual patterns rather than group propensities and they were concerned with interest and choice in the core curriculum areas of reading and mathematics as well as in

the elective areas. They saw student interests as manipulatable by the teacher and easily influenced by factors external to the student such as peer pressure or the attractiveness of materials. They accepted the expression of student interest at face value without probing to discover the meaning of a particular expression of interest. Student choice was seen both as a process of selection from among alternatives and an opportunity for the student to exercise responsibility to follow through on his or her choice.

Orientation D teachers (28%) assumed that interest is a quality of all children and that there is continuity and strength in this interest. Teacher observation and inquiry were seen as means of bringing out student interests. Their perceived responsibility was not to create interest but to identify the interests already held by students. Interests were not thought of as needs to be satisfied, but rather as useful starting points for investigations into all parts of the curriculum. Extending interests beyond their initial expression was an important learning objective for these teachers. Their notion of student choice was of a continuing process of children evaluating the directions in which pursuit of their interests were taking them. These teachers believe it is important to help the student focus on the skill of making good choices in the process of extending his or her interests, including the choice of not extending a particular interest.

Finally, Bussis et al. grouped teachers into four orientations with regard to their beliefs about the role of social interaction among children. Orientation A teachers (18%) reported that interaction among students was generally not significant for learning. Orientation B teachers (5%) saw children's social interaction as potentially interfering with learning.

Orientation C teachers (37%) saw children's social interaction as a process of children instructing one another (e.g., as peer tutors) or as a process of learning socially accepted norms for behavior. Orientation D teachers (40%) perceived interaction as a process of children learning from one another in both the cognitive and social-emotional domains.

Based on the categorization of the teachers' responses to the working environment section of the interview, the researchers rated the teachers on the complexity of their views about other adult roles in institutional policies and the initiative they seemed to be taking in the development of working relationships. They found that in most every school the aides and parents were much more salient in the teachers' thinking than were the principal and school. Ratings of initiative for the development of working relationships was highest for aides and parents and lowest for school administrators, with ratings for the development of a working relationship with other teachers falling somewhere in between. A comparison of the teachers' views of the adult-as-resource and the child-as-resource suggested what the researchers refer to as a pyschological consistency in thinking about adults and children. For example, teachers who saw no resource value in children also had low mean ratings on development of working relationships with other adults, and the majority of teachers who saw high resource value in children also gave a high rating to development of adult resources. Bussis et al. concluded from these findings that construct systems regarding the development of human resources embrace both beliefs about children and beliefs about adults.

Conclusions

The studies reviewed in this chapter are in the vanguard of the approach to research on teaching that emphasizes teacher thinking. Many of these studies raise more questions about method and substance than they answer. Yet we have made some progress in learning about the mental lives of teachers.

On the topic of teacher planning, the available literature suggests that teachers do not seem to follow the "rational model" that is often prescribed in teacher training and curriculum planning. In particular, the teachers studied neither began nor guided their planning in relation to clearly specified objectives or goals. Rather, teacher planning seems to begin with the content to be taught and considerations about the setting in which teaching will take place. The focus then shifts to student involvement as a process objective. The activity, rather than the objective, seems to be the unit of planning. Yinger's model (Note 2) further proposes that planning is the progressive elaboration of a major idea, in contrast to the development of a number of alternatives and the selection of the optimum alternative from this set.

Research on teacher planning should focus on more representative field studies of the planning process to complement description and analysis of teacher planning in highly controlled laboratory settings. Beyond this, there is a need for research on the psychology of planning, as well as description of the process. At this time we know very little about why teachers plan, how teacher planning behavior changes with experience, and whether individual difference variables influence the quantity and style of teacher planning. Finally, there is a need for research on the relationship between planning and subsequent action. This last question is perhaps the most

promising point of contact between research on teacher thinking and teaching effectiveness. It is here that the outcomes of planning, both in terms of organizing classroom interaction for the teacher and in influencing student involvement and learning can be seen.

The findings about teacher judgment are less clear-cut than those about teacher planning. The small number of teacher-judgment studies yield results that are often very rich in the information they provide about a specific judgment task, but the uniqueness of these tasks prevents us from making general statements about teacher judgment. The studies of teacher judgment reviewed here involve teachers making judgments about students, (Mondol, note 10; Shavelson etal., 1977; and Joyce et al., Note 8), teachers (Anderson, 1977), and materials (Clark et al., Note 9). The evidence is mixed on the extent to which teachers' judgments are flexible and responsive to new information. It is clear that teachers vary in the accuracy of their predictions of student achievement and the weights that they assign to factors that influence their judgment. Mondol's study suggests that training can be used to change teachers' judgment policies.

For future research on teacher judgment to be useful in policy and training decisions, a greater number and variety of studies is required -- studies of teacher judgments about students, curriculum materials, and other important aspects of the classroom environment. Once a sufficient number of such studies is available, we will be able to make more general statements about the judgment process in each of these domains and suggest more systematic and effective judgment strategies in these areas.

The studies of teacher interactive decision making reviewed here reflect a series of refinements in the method of collecting data about such decisions.

The method of conducting stimulated recall interviews has changed from using very short, randomly-selected videotaped segments and asking a standard set of questions about each segment to reviewing a videotape in its entirety and giving the teacher control over when to stop the tape and what kinds of mental processes to focus on. Another trend has been to move from the laboratory situation to the real classroom. Both of these developments have made the problems of data reduction and analysis more challenging, but have also increased the representativeness of the situations under study.

The few findings available indicate that teacher interactive decision making occurs primarily at times when there are interruptions of the ongoing instructional process by students. The teachers studied seem to be monitoring student involvement as their primary index of smoothness of the instructional process. When interruptions occurred, teachers occasionally considered alternatives but hardly ever implemented those alternatives. That is, for various reasons, teachers tend not to change the instructional process in mid-stream, even when it is going poorly.

The literature on teachers' implicit theories is more eclectic than the other material reviewed in the chapter. There appears to be little consensus, but the common thread in these studies is the belief that teacher thinking and teacher behavior are guided by a set of organized beliefs, often operating unconsciously. The study by Duffy (Note 14) suggests that the connection between a teacher's implicit theory and his or h . behavior is a relatively loose one, mediated by circumstances such as ilability of resources, peer influence, and student characteristics. More research is required on the relationship between teacher implicit theories and teacher perceptions, information processing, and behavior.

Researchers on teacher thinking have made a promising start toward understanding the reasons why teachers behave as they do. This understanding should grow and develop as more research of this kind is done; the most exciting possibility is that research on teacher thinking may unite the concerns of researchers on instruction and teacher behavior with those of researchers on curriculum and materials. All of these concerns come together in the minds of teachers as they make the plans, judgments, and decisions that guide their behavior. Indeed, the thinking of teachers may be the strategic research site that yields the first practical theory of instruction.

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